
Concise Review: Human Dermis as an Autologous Source of Stem Cells for Tissue Engineering and Regenerative Medicine.

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Funding Grants: Tissue engineered cartilage from autologous, dermis-isolated, adult, stem (DIAS) cells

Public Summary:

Using an individual's own stem cells for regenerative medicine is an exciting field, and stem cells derived from the skin are particularly appealing because skin biopsies are easy to collect and relatively minimally invasive. Dermis derived adult stem cells (DSCs) are a set of stem cells from the skin. A substantial number of reports have described DSCs and their potential for regenerating various tissues. However, the exact niches of these stem cells and their precise characteristics are not yet clearly defined. DSCs isolated and propagated using various methods have shown similar abilities in forming various tissue types. However, only limited clinical applications have thus far been developed from DSCs. This review summarizes the literature on DSCs derived from various locations within the dermis; the specific characteristics of each subset of DSCs are described. Also, DSCs' ability to transform into cells of different tissue types as well as advantages and disadvantages of methods used to induce such transformations are discussed. Safety considerations and the most recent advancements in the field of tissue engineering and regeneration using DSCs are reviewed. Thoughts are also offered on how to approach tissue engineering and organ regeneration using DSCs.

Scientific Abstract:

The exciting potential for regenerating organs from autologous stem cells is on the near horizon, and adult dermis stem cells (DSCs) are particularly appealing because of the ease and relative minimal invasiveness of skin collection. A substantial number of reports have described DSCs and their potential for regenerating tissues from mesenchymal, ectodermal, and endodermal lineages; however, the exact niches of these stem cells in various skin types and their antigenic surface makeup are not yet clearly defined. The multilineage potential of DSCs appears to be similar, despite great variability in isolation and in vitro propagation methods. Despite this great potential, only limited amounts of tissues and clinical applications for organ regeneration have been developed from DSCs. This review summarizes the literature on DSCs regarding their niches and the specific markers they express. The concept of the niches and the differentiation capacity of cells residing in them along particular lineages is discussed. Furthermore, the advantages and disadvantages of widely used methods to demonstrate lineage differentiation are considered. In addition, safety considerations and the most recent advancements in the field of tissue engineering and regeneration using DSCs are discussed. This review concludes with thoughts on how to prospectively approach engineering of tissues and organ regeneration using DSCs. Our expectation is that implementation of the major points highlighted in this review will lead to major advancements in the fields of regenerative medicine and tissue engineering. SIGNIFICANCE: Autologous dermis-derived stem cells are generating great excitement and efforts in the field of regenerative medicine and tissue engineering. The substantial impact of this review lies in its critical coverage of the available literature and in providing insight regarding niches, characteristics, and isolation methods of stem cells derived from the human dermis. Furthermore, it provides analysis of the current state-of-the-art regenerative approaches using human-derived dermal stem cells, with consideration of current guidelines, to assist translation toward therapeutic use.

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